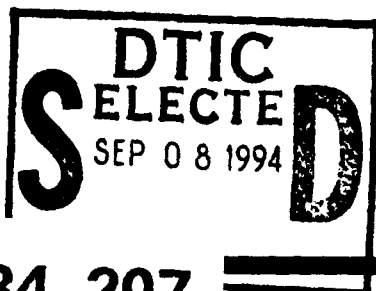




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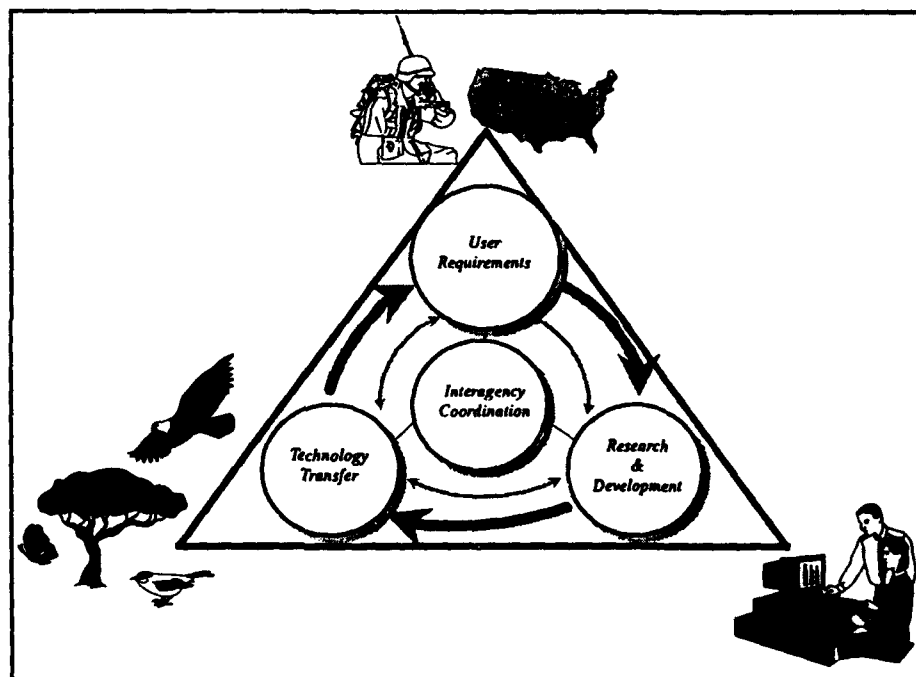
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June 1994

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U.S. Army Threatened and Endangered Species Research and Development Strategy and Action Plan

by
David J. Tazik
Chester O. Martin



The U.S. Army's environmental vision, as described in the *U.S. Army Environmental Strategy into the 21st Century*, is to support a proactive conservation posture with respect to natural and cultural resources, including Threatened and Endangered species (TES) and associated ecosystems, while maintaining a mission focus. This report defines the Army's approach and framework for planning, execution, and transfer of research necessary to deal effectively with challenges to TES on Army lands. The strategy establishes the process, approach, and focus the Army

research and development community will use to develop cost effective products and capabilities to meet requirements under the Endangered Species Act and applicable Army regulations. It also ensures efficient allocation of R&D resources, appropriate levels of inter-service and interagency coordination, and timely transfer of useful research products to the field. The action plan translates the goals and objectives that support the strategy into specific implementing actions. Taking these actions will ensure that the strategy is carried out to support the vision.

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Executive Summary

This *U.S. Army Threatened and Endangered Species Research and Development Strategy and Action Plan* (TES R&D Strategy) defines the Army's approach and framework for planning, execution, and transfer of research necessary to deal effectively with challenges to threatened and endangered species (TES) on Army lands. The Army's environmental vision, as described in the *U.S. Army Environmental Strategy into the 21st Century*, establishes the framework for the TES R&D Strategy. The latter, in turn, supports the Army environmental vision. It supports the Army in a proactive conservation posture with respect to TES and associated ecosystems while supporting a mission focus. The TES R&D Strategy also embraces the *Army Strategy for the Management of Endangered Species* and recent Army TES policy presented in draft Army regulations.

The strategy establishes the process, approach, and focus the Army R&D community will use to develop cost-effective products and capabilities to meet requirements under the Endangered Species Act (ESA) (Public Law [PL] 93-205 28 December 1973) and applicable Army regulations. It also ensures efficient allocation of R&D resources, appropriate levels of interservice and interagency coordination, and timely transfer of useful research products to the field. Development of this strategy is timely given:

- Stringent requirements under the ESA that have affected the mission at several installations
- Increasing constraints on mission activities as the number of species listed increases, and potential strengthening the ESA in the next series of amendments
- Federal budget constraints that place a greater premium on effective resource leveraging and avoiding duplicate efforts among federal agencies
- The need for credible scientific leadership to support effective Army TES initiatives
- Potential benefits to the Army's conservation strategy and national TES-related environmental policy goals.

The TES R&D Strategy was developed at the request of the U.S. Army Corps of Engineers (USACE) Directorate of Research and Development (CERD). To initiate development of the strategy, USACE established an Army TES R&D Working Group. This group, composed of Corps Laboratory personnel and other Army R&D elements, met to outline of the strategy, provide input, and review interim drafts.

The strategy itself establishes the processes and management structure that provide specific products and capabilities to the field to help achieve the TES R&D vision. The model for the strategy is based on a triangle. Internally, the triangular components represent the three major Army-centered processes of:

- Defining user requirements
- Planning and executing appropriate R&D
- Transferring useful R&D products to the field efficiently and effectively.

At the center of the model is a fourth element, interagency coordination and cooperation. This central item touches on each of the other elemental processes. It emphasizes the need to identify common R&D requirements across agencies and opportunities for cooperative R&D, avoid duplication of effort, and establish partnerships in transfer of technologies to the field. The matrix within the triangle represents a fifth, program management element designed to integrate the four process elements.

Externally, the triangle ties critical resources together; i.e., Army research, threatened and endangered species, and the soldier and nation. It illustrates that mission support is the focus of the research effort, with consideration for both national defense and environmental policy goals.

The action plan translates the goals and objectives that support the strategy into specific implementing actions. Taking these actions will ensure that the strategy is carried out to support the vision.

Foreword

This study was conducted for the Directorate of Research and Development (CERD), Headquarters, U.S. Army Corps of Engineers (HQUSACE) under Project 4A162720A896, "Environmental Quality Technology"; Work Unit TY4, "Inventory and Monitoring of Rare and Endangered Species." The technical monitor was Thomas Hart, CEMP-M.

The work was performed by the Environmental Natural Resources Division (EN), Environmental Sustainment Laboratory (EL), U.S. Army Construction Engineering Research Laboratories (USACERL) with the cooperation and assistance of the Natural Resources Division, Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station (USAEWES). The USACERL principal investigator was Dr. David J. Tazik. The USAWES co-investigator was Chester O. Martin. Dr. William Severinghaus is Acting Chief, CECER-EN and Dr. William Goran is Chief, CECER-EL. The USACERL technical editor was William J. Wolfe, Information Management Office.

Completion of the strategy outlined in this document required much coordination among USACE laboratories: USAEWES, Cold Regions Research and Engineering Laboratory (USACRREL), and the Topographic Engineering Center (USATEC). It also benefited from input from various Army sources. The strategy outlined in this report was developed with the contributions of many individuals: Christine Bern and Robert Shaw (Center for the Ecological Management of Military Lands, Colorado State University); John Bushman and Forester Einarsen (Directorate of Civil Works, U.S. Army Corps of Engineers); Donald Bandel, Phillip Pierce, and LTC (Retired) Charles Wright (Directorate of Environmental Programs, Department of the Army); Thomas Hart (Directorate of Research and Development, U.S. Army Corps of Engineers); LTC Bruce Sneddon, (Directorate of Training, Department of the Army); MAJ Robert Kull (U.S. Air Force Armstrong Laboratory); William Rushing (Directorate of Research and Development, U.S. Army Corps of Engineers); William Russell and William Seegar (U.S. Army Edgewood Research, Development and Engineering Center); Chris Demeroukas, John Fittipaldi, and Carol Foley (U.S. Army Environmental Policy Institute); Timothy Hayden, Alison Hill, Anthony Krzysik, Robert Lacey, Keturah Reinbold, Paul Schomer, Pamela Taylor, Steven Warren, and James Westervelt (USACERL); Darryl Calkins, Charles Racine, and Marianne Walsh (USACRREL); Steven Getlein and Kevin Slocum (USATEC); Dena Dickerson, Chester Martin, Andrew Miller, Edwin Theriot and Conrad J. Kirby (USAEWES).

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1 The Army's Vision for Threatened and Endangered Species Conservation

The Army's stated vision for the conservation of threatened and endangered species is that:

The Army will be a national leader in proactive conservation of threatened and endangered species and the ecosystems upon which they depend as an integral part of our mission.

This vision is a direct corollary of the Army's Environmental Vision, which states that:

The Army will be a national leader in environmental and natural resource stewardship for present and future generations as an integral part of our mission.

Together, these vision statements clarify the Army's leadership commitment in environmental compliance and conservation. Each clearly shows the Army's intended proactive posture regarding natural resources issues, including issues that involve threatened and endangered species (TES). Together, they establish the framework for development of the TES research and development strategy and action plan (TES R&D Strategy).

2 The Need for an Army TES R&D Strategy

Purpose

The purpose of the Army's TES R&D Strategy is to:

- Establish the process, approach, and focus for the Army R&D community to follow in providing cost-effective technologies that are responsive to user needs and designed to enhance Army capabilities to proactively meet compliance and conservation requirements under the Endangered Species Act and applicable Army regulations
- Provide the means to identify, prioritize, and allow for the effective allocation of resources to deal with both general and species-specific TES issues
- Emphasize use of the full range of available R&D resources and capabilities both within and outside the Army and Department of Defense, and to avoid duplicating the efforts of other organizations
- Ensure the timely transfer of products and systems to the user community.

Current Legal Requirements

The Endangered Species Act (ESA) is the most far-reaching legislative initiative taken by the federal government to protect plant and animal life. Congress established it to protect species threatened with extinction. A critical feature of the ESA is the responsibility it places on all federal agencies to protect listed species that occupy lands under their control and those affected by their actions. The act protects listed species by:

- Restricting taking (hunting and trapping)
- Regulating trade
- Providing habitat acquisition authority
- Providing for species enhancement and recovery plans
- Mandating that impacts to species and critical habitat due to federal activities be considered before those activities are begun
- Recognizing the international scope of the problem.

The ESA is the only piece of environmental legislation that has resulted in stoppage of military training activities on Army lands.

Changing Legal Requirements

Recent discussions surrounding reauthorization of the ESA along with related legislative activity addressing biodiversity, and the increasing attention to ecosystem management approaches within the Clinton Administration suggest that a reauthorized ESA will:

- Place greater emphasis on enforcing requirements of TES recovery plans
- Require clearing out the backlog of listed species without recovery plans
- Place greater emphasis on an ecosystem approach to TES management and planning.

The potential impacts of these actions on the Army mission, including land management activities, are unknown.

Army Relevance

There has been increasing concern about the impact of TES management requirements on the Army mission. Several recent events have highlighted the potential for TES to affect combat readiness and support operations. For example:

- At Fort Bragg, training restrictions imposed in response to the large number of red-cockaded woodpecker (RCW) clusters on the Fort were identified as a threat to sustained combat readiness of the contingency force.
- Also at Fort Bragg, a critical \$20 million range complex was temporarily closed due to the presence of the RCW.
- At Fort Benning, GA, three civilian employees were indicted for failing to comply with endangered species regulations.
- A major land acquisition at Fort Irwin has been delayed by the presence of a substantial population of the desert tortoise.
- Discovery of protected plant species at Pohakuloa Training Area has jeopardized use of a \$24 million Multiple-Purpose Range Complex.

These events have resulted in creation of an Army Endangered Species Team at Headquarters (HQ), Department of the Army (DA). Two products of this team include the *Army Strategy for Management of Endangered Species*, and a redraft of DA TES

policy guidelines (discussed in Chapter 3). Scientific data is needed to carry out both of these initiatives.

Programmatic Considerations

Development of a TES R&D Strategy is essential to ensure that the R&D program supporting TES management:

- Meets the needs of the field now and in the future
- Fully leverages all Army and Department of Defense (DOD) R&D resources and capabilities
- Does not duplicate the efforts of other federal, state, and nongovernmental agencies
- Delivers appropriate technologies to the field quickly.

Leadership

Credible TES scientific leadership and research capability within the Army is essential to:

- Comply with the spirit of the Army's environmental strategy
- Meet requirements of the Army Strategy for Management of Endangered Species and Army TES regulations
- Effectively integrate TES conservation with mission requirements
- Maintain an effective dialogue with TES regulatory agencies
- Effectively participate in interagency research and management initiatives
- Meet public trust responsibilities.

Benefits

Threatened and endangered species represent a significant and growing challenge to land management on military installations throughout the United States. TES are no less challenging to other federal land management agencies and often affect the private sector as well. Conservation and management strategies that balance TES needs with other land use requirements are essential to the Army mission. The TES R&D Strategy is intended to provide the needed tools, techniques, and information to meet the challenge of responsible environmental land management, to balance competing land use requirements, and to support the Army's mission. Each of these activities benefits the nation, its resources, and its people.

3 Development of the Strategy

Background

The framework for the TES R&D Strategy is founded on two related strategies—the *U.S. Army Environmental Strategy into the 21st Century*, and *Army Strategy for the Management of Endangered Species*. It also reflects recent interim policy guidelines for TES management on Army lands specified in Chapter 11 of Draft Army Regulation (AR) 200-3, *Natural Resources—Land, Forest, and Wildlife Management*. The goals and objectives of the TES R&D Strategy support and complement the goals and objectives laid out in these documents. Resulting R&D activities are expected to do likewise.

U.S. Army Environmental Strategy into the 21st Century

The *U.S. Army Environmental Strategy into the 21st Century* lays out the Army's leadership commitment and philosophy for meeting present and future environmental challenges. Developed under the direction of the Secretary and Chief of Staff of the Army, it commits the Army to becoming a national leader in environmental and natural resource stewardship as an integral part of the Army mission. Also, it is the basis for planning, programming, and budgeting and execution of decisions related to the Army's environmental program. It establishes the vision and framework, and the leadership and impetus for defining research and development goals related to the environmental stewardship commitment, including conservation of threatened and endangered species.

Under this strategy, the Army hopes to achieve environmentally sustainable operations at all of its military facilities, to enhance national security and quality of life, and to meet similar environmental standards at all Army civil works facilities. Emphasis is on integration of stewardship with the military mission. The strategy itself includes four major elements, or "pillars":*

* The term "pillar" reflects the unique structure of the strategy, which is modeled after a building with a foundation and four pillars supporting the overall vision of environmental stewardship in support of the Army mission. The foundation is made up of a bedrock of shared national values, foundation blocks including people, resources, communication, and management and organization, based on a footing of solid leadership.

- **Compliance:** Sustain compliance with all environmental laws
- **Restoration:** Restore previously contaminated sites
- **Prevention:** Minimize or eliminate pollution at its source
- **Conservation:** Conserve, preserve, and enhance natural and cultural resources for present and future generations.

Threatened and endangered species, although a compliance issue, fall under the Conservation Pillar and are closely linked to integrated natural resources management.

Army Strategy for the Management of Endangered Species

The *Army Strategy for the Management of Endangered Species* strives to maintain a trained and ready Army while meeting compliance and stewardship responsibilities under TES legislation. The strategy's four major goals are to:

- Institutionalize the management process for resolving Army-wide endangered species issues at the DA level
- Provide effective DA-level scientific, technological, and funding support to major commands (MACOMs) and installations in the management of endangered species and related natural resources
- Engender proactive attitudes within the Army in managing the conservation of endangered species as part of environmental compliance and stewardship while meeting the imperative of maintaining a trained and ready Army
- Establish cooperative and mutually beneficial working relationships with other DOD and federal agencies, states, and public interest organizations on endangered species matters.

Army Policy

The interim policy guidelines for TES as defined in Chapter 11 of AR 200-3 state that the Army will:

- Show leadership by balancing mission requirements and the conservation of listed species through long-term planning and effective management
- Work closely and cooperatively with regulatory agencies in fulfilling its conservation responsibilities under the ESA
- To the greatest extent practicable, develop and implement policies and strategies to assist, in cooperation with other landowners, in the conservation of biological diversity.

This document outlines the responsibilities of and specific actions to be taken by installations, MACOMs, and DA in fulfilling their obligation to effectively manage TES on Army lands. TES research and technical support requirements ultimately derive from the regulatory requirements laid out in this document.

Assumptions

Several assumptions that have gone into development of the TES R&D Strategy include:

- The Army is and will remain committed to proactive conservation of natural resources.
- An increase in the number of TES listed together with increased military training on existing Army lands will result in increasing conflict between mission activities and TES management requirements, possibly jeopardizing combat readiness.
- The ESA and related environmental legislation will become broader in scope, potentially increasing constraints on Army missions.
- The Army is committed to carrying out the *Army Strategy for the Management of Endangered Species*.
- TES R&D is an integral part of the Conservation Pillar research program.
- Insufficient funds are available within existing Army Conservation Pillar R&D programs to fully fund research required to cover all TES requirements.
- There is a critical need to focus Army R&D on military-related issues, but within the broad spirit of the Army's environmental stewardship vision.
- The Integrated Training Area Management (ITAM) Program is the Army's training and testing land management program. It is the foundation for development and application of TES management activities on Army training and testing lands.

Approach

The U.S. Army Corps of Engineers (USACE) established an Army TES R&D Working Group during January 1993 to develop the TES R&D Strategy. The working group consists of representatives from each USACE research laboratory, USACE Directorate of Research and Development (CERD), Edgewood Research, Development, and Engineering Center (ERDEC), Army Environmental Hygiene Agency (AEHA), Office of the Director of Environmental Programs (DAIM-ED), Office of the Director of Army Training (DAMO-TRS), Army Environmental Policy Institute (AEPI), U.S. Air Force

Noise and Sonic Boom Impact Technology (NSBIT) Program, and the Center for Ecological Management of Military Lands (CEMML) at Colorado State University.

The working group met 3-4 February 1993 to share information on current Army TES-related R&D activities and to develop a strategy outline. Sections of the strategy were prepared with the assistance of various members of the working group. The working group reviewed an initial draft during May 1993. Further refinements were achieved as a result of a second meeting held during 22-23 June.

Scope

This strategy addresses Army military-related TES R&D requirements. However, other DOD and Army civil works TES R&D needs can be met, at least in part and if adequately supported, as a result of ensuing research efforts. Furthermore, the military-related strategy presented here will benefit from research conducted by Army civil works, other DOD elements, and agencies and academic institutions outside DOD. Proposed program management activities are designed to ensure this result. Furthermore, the strategy itself serves as a model for adaptation by DOD.

It is also recognized that TES R&D is but one part of a broader natural resources R&D effort that includes ecosystem and biodiversity considerations, and must fit into this effort in a logical way. This will be accomplished as the Army moves forward in development of a broader Conservation Pillar R&D program and associated program management capabilities.

4 The Strategy

The Army's strategy for implementing TES R&D is to:

Establish and execute an integrated approach to provide products and capabilities for proactive conservation of threatened and endangered species and the ecosystems upon which they depend consistent with the Army mission and the ESA.

This strategy is an outgrowth of the Conservation Pillar goal, which commits the Army to:

Conserve, protect, and enhance environmental and natural and cultural resources, using all practicable means consistent with Army missions, so that present and future generations may use and enjoy them.

It also recognizes compliance requirements under the ESA, and the need to address the ESA specific compliance requirements in the short term. Yet, in the long term, it looks toward biodiversity and ecosystem management considerations.

The TES R&D Strategy establishes the processes, direction, and framework necessary to attain the TES R&D vision. The several goals and objectives supporting the strategy provide the basis for specific implementing actions presented in Section 5. These goals and objectives focus on five major processes:

- User requirements identification
- R&D design and execution
- Technology transfer
- Interagency coordination and cooperation
- Program Management.

Under this strategy, the Army will be able to identify and carry out the R&D essential to the mission, avoid duplicating the efforts of other agencies, and maximize the productivity of R&D resources as applied to TES on Army lands.

The Model

The model for this strategy is based on a triangle (Figure 1). Internally, the triangular components represent the three major processes of defining user requirements, designing and conducting appropriate R&D, and transferring R&D products to the field. Externally, the triangle ties together critical resources; i.e., Army research, TES, and the soldier and nation. The soldier and nation are at the apex to show that mission support and national interests are the primary focus of the strategy, with benefits ultimately accruing to national defense and environmental policy goals. Note also that TES represent the broader natural resource and ecosystem base on which mission activities are conducted. TES are indicators of ecosystem health, the maintenance of which is critical to sustaining the mission and national security. At the center of the model is the fourth element of the strategy, namely, interagency coordination and cooperation. This element is central in that it touches on each of the other elemental processes. That is, an effective strategy requires that we identify:

- Common R&D requirements across agencies
- Opportunities for cooperative R&D
- Partnerships in transfer of technologies to the field
- And avoid duplication of effort.

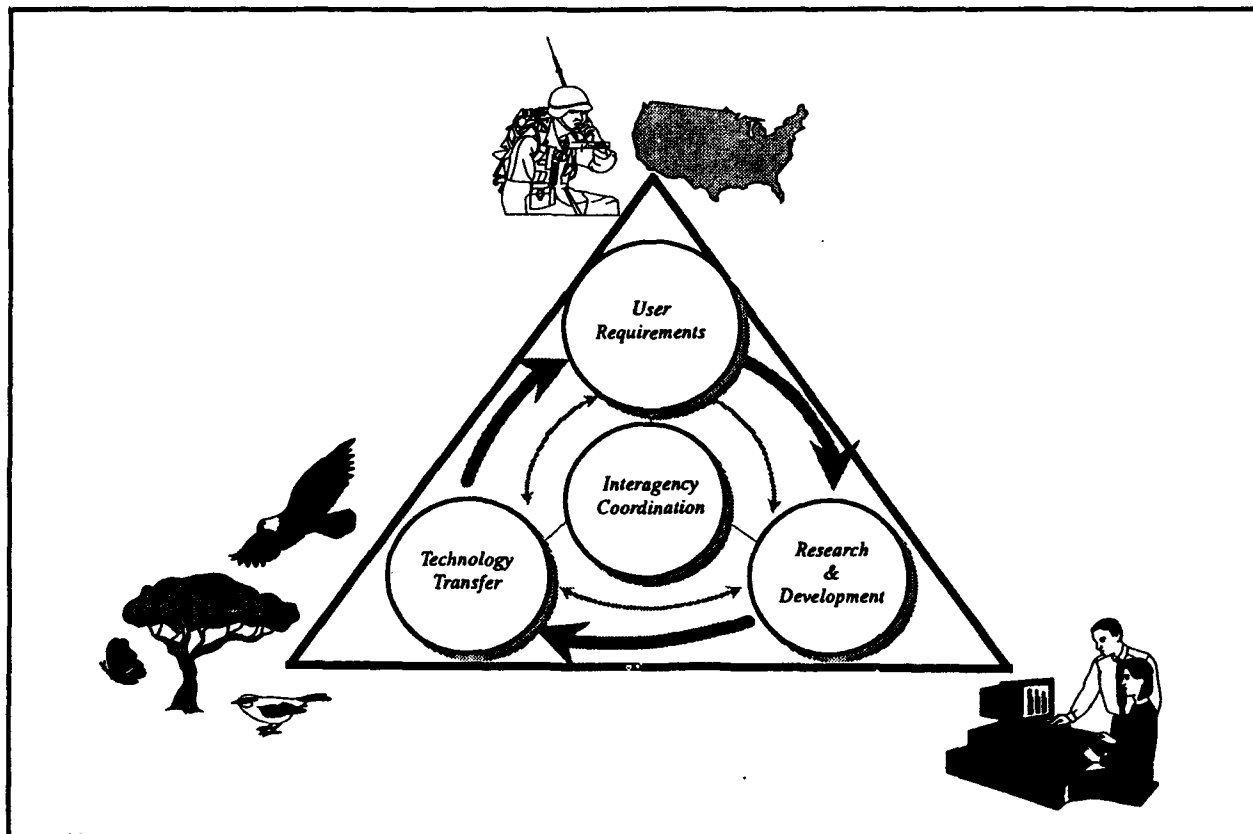


Figure 1. Model of TES R&D Strategy.

The large directional arrows represent the cyclical nature of the total process. The smaller bidirectional arrows display the criticality of forward and backward communication to ensure checks and balances throughout. The matrix within the triangle represents the fifth program management element, which binds and inter the processes.

Summary of Goals and Objectives

A synopsis of goals and objectives for the strategy and action plan follows:

Goal 1, User Requirements: Design and carry out a process to identify TES R&D requirements and priorities.

Objective 1a. Establish an organizational structure to manage development of TES R&D requirements.

Objective 1b. Establish a process to identify, validate, prioritize, and integrate TES user requirements.

Goal 2, R&D Design and Execution: Design and carry out an R&D program that is responsive to Army TES program requirements.

Objective 2a. Translate program requirements into executable research, and develop an R&D plan that addresses TES program requirements.

Objective 2b. Establish mechanisms to coordinate across USACE Labs and DOD.

Objective 2c. Establish a mechanism to review, validate, and complete proposed TES R&D plans and roadmaps.

Objective 2d. Establish a mechanism to periodically review ongoing R&D execution, and to refine and redirect as needed.

Goal 3, Technology Transfer: Establish mechanisms for timely and effective technology transfer of products and capabilities to users.

Objective 3a. Establish methods to accomplish timely transfer of technology as user products, tools, and services.

Objective 3b. Develop procedures to accomplish information exchange (internally and externally) throughout all phases of the program.

Objective 3c. Test and demonstrate technology under DA field conditions.

Goal 4, Interagency Coordination and Cooperation: Establish mechanisms for interagency coordination and cooperation intended to avoid duplication of effort and identify opportunities to leverage resources to accomplish common objectives.

Objective 4a. Establish mechanisms to coordinate and cooperate with state, federal, and nongovernmental agencies in design and implementation of an integrated complementary TES R&D program to avoid duplication of effort.

Objective 4b. Establish innovative mechanisms to partner and coordinate TES R&D resources across agencies.

Objective 4c. Encourage, facilitate, and fully participate in regionally-based R&D initiatives directed at TES and biodiversity.

Objective 4d. Identify opportunities to support international conservation R&D initiatives directed at TES and biodiversity.

Goal 5, Program Management: Establish the process and management structure to integrate and execute the TES program.

Objective 5a. Refine the R&D process to streamline and ensure review and feedback of process and approach between the user and researcher.

Objective 5b. Ensure adequate coordination of R&D program elements to correctly target research activities and balance the various funding sources.

Objective 5c. Establish a process/program structure to ensure that the overall functionality of R&D products and systems meet user requirements.

Objective 5d. Ensure that the TES R&D program elements and products consist of and reflect the knowledge that is state-of-the-art in the field.

5 Action Plan

Tables 1 through 5 spell out specific steps to be taken in implementing the "action plan" that will carry out the strategy.

Table 1. Breakdown of Goal 1, User Requirements: Design and carry out a process to identify TES R&D requirements and priorities.

Objectives	Actions	Timeline	Resources	POC
1a. Establish an organizational structure to manage development of TES R&D requirements.	1. Establish TES User Working Group to provide input to and review TES R&D program.*	2QFY94	EC**	DAIM-ED, MACOMs
1b. Establish a process to identify, validate, prioritize, and integrate TES user requirements.	1. Conduct Conservation Pillar R&D Prioritization Workshop.	Complete		DAIM-ED
	2. Refine user requirements at TES R&D and User Working Group Meeting (See Action 2a-2).	2QFY94	EC	DAIM-ED, MACOMs USACE labs
	3. Use results of Inter-agency Coordination Workshop to refine user requirements (See Action 4a-1).	3QFY94	EC	DAIM-ED
	4. Complete an evaluation of the TES R&D program relative to validated user requirements and staff recommendations to CERD.	3QFY94	EC	DAIM-ED
<p>* This group will function within the context of a Conservation Pillar User Group formed to address natural resources R&D.</p> <p>** Embedded Cost</p>				

Table 2. Breakdown of Goal 2, R&D Design and Execution: Design and carry out an R&D program that is responsive to Army TES program requirements.

Objectives	Actions	Timeline	Resources	POC
2a. Translate program requirements into executable research, and develop an R&D plan that addresses TES program requirements.	1. Complete strawman TES R&D plan.	2QFY94	See Action 5b-1	USACE Labs
	2. Review of strawman plan by R&D and User Working Groups.	2QFY94	See Action 5a-3	USACE Labs, DAIM-ED, MACOMs
	3. Finalize draft plan for annual R&D program reviews (See Action 1b-4)	2QFY94	See Action 5b-1	USACE Labs
2b. Establish mechanisms to coordinate across USACE Labs and DOD.	1. Complete USACE Inter-lab TES Reliance Partnership Plan.	1QFY94	See Action 5b-3	USACE Labs
	2. Establish Army TES R&D Working Group.	Complete		USACE Labs
	3. Use Tri-Service RELIANCE Agreement for DOD Coordination.	Ongoing	EC	CERD, USACE Labs
	4. Establish communications network among USACE and DOD TES researchers.	1QFY95	See Action 5b-1	USACE Labs
2c. Establish a mechanism to review, validate, and complete proposed TES R&D plans and roadmaps.	1. Brief draft plan at annual Conservation Pillar review (See Action 1b-4)	3QFY94	See Action 5b-1	USACE Labs
	2. Incorporate DAIM-ED evaluation and recommendations into final program guidance (See Action 1b-5)	3QFY94	EC	CERD
	3. Revise/finalize TES R&D plan	4QFY94	See Action 5b-1	USACE Labs
	4. Provide input to the POM.	2QFY95	EC	CERD

Objectives	Actions	Timeline	Resources	POC
2d. Establish a mechanism to periodically review on-going R&D execution, and to recommend refinements and modifications.	1. Initiate annual TES R&D User Group meetings to review program status and develop recommendations for program refinements (See Action 2a-2)	2QFY94	See Action 5a-3	USACE Labs
	2. Initiate annual program briefing in conjunction with Conservation Pillar R&D review (See Action 2c-1)	3QFY94	See Action 5b-1	USACE Labs
	3. Initiate process to submit annual program evaluation and recommendation to CERD (See Action 1b-5).	3QFY94	EC	DAIM-ED
	4. Initiate a process to provide guidance to labs for program modifications (See Action 2c-2).	3QFY94	EC	CERD
	5. Initiate a process to refine TES R&D plan annually (See Action 2c-3).	4QFY94	See Action 5b-1	USACE Labs

Table 3. Breakdown of Goal 3, Technology Transfer: Establish mechanisms for timely and effective technology transfer of products and capabilities to users.

Objectives	Actions	Timeline	Resources	POC
3a. Establish methods to accomplish timely transfer of technology as user products, tools, and services.	1. Assimilate and synthesize existing technology on selected species, ecosystems, and conservation strategies and develop a mechanism to make this information available to the field; making full use of information available via interagency partners (see Goal 4).	4QFY94	\$50K	USACE Labs
	2. Draft a TES technology transfer plan, identifying media and formats for dissemination of technology to the field; coordinating as appropriate with interagency partners (see Goal 4).	4QFY94	See Action 5c-3	USACE Labs
3b. Develop procedures to accomplish information exchange (internally and externally) throughout all phases of the program.	1. Initiate annual TES R&D and User Working Group Meetings (See Action 2a-2)	2QFY94	See Action 5a-3	USACE Labs
	2. Initiate technical note/bulletin series describing TES R&D program status and results to date	4QFY94	See Action 5c-3	USACE Labs
	3. Establish a database for storing and retrieving TES research and management information.	1QFY95	EC*	USACE Labs
	4. Institute a network system for internal and external distribution of technology to the appropriate offices and installations.	2QFY95	EC	USACE Labs
*To be accomplished in conjunction with ongoing TES database development.				

Objectives	Actions	Timeline	Resources	POC
3c. Test and demonstrate technology under DA field conditions.	1. Incorporate technology demonstration activities in TES R&D plan (See Action 2a and 2c).	4QFY94	See Action 5b-1 and 5c-3	USACE Labs
	2. Coordinate with User Working Group in regional screening of installations and potential TES demonstration sites and B-test sites.	1QFY95	See Action 5c-3	USACE Labs
	3. In coordination with User Working Group, select new and emerging technologies to demonstrate at installations.	1QFY95	See Action 5c-3	USACE Labs
	4. Establish partnerships with other agencies and organizations for assistance with demonstration activities.	2QFY95	See Action 5c-3 and 5d-3	USACE Labs

Table 4. Breakdown of Goal 4, Interagency Coordination and Cooperation: Establish mechanisms for interagency coordination and cooperation intended to avoid duplication of effort and identify opportunities to leverage resources to accomplish common objectives.

Objectives	Actions	Timeline	Resources	POC
4a. Establish mechanisms to coordinate and cooperate with state, federal, and nongovernmental agencies in design and application of an integrated complementary TES R&D program to avoid duplication of effort.	1. Initiate biannual interagency, coordination workshops.	3QFY94	See Action 5d-2	DAIM-ED, CERD, USACE Labs
	2. Complete Interagency Coordination Plan	4QFY94	See Action 5d-3	USACE Labs
	3. Establish a TES interagency communications network between DOD labs and other agencies and organizations.	1QFY95	See Action 5d-3	USACE Labs
4b. Establish innovative mechanisms to partner and coordinate TES R&D resources across agencies.	1. Investigate methods for resource-sharing on TES issues of mutual concern to Army and other agencies.	4QFY94	See Action 5d-3	CERD, USACE Labs
	2. Establish inter-agency working groups to address special issues as needed.	TBD	See Action 5d-3	USACE Labs
4c. Encourage, facilitate, and fully participate in regionally-based R&D initiatives directed at TES and biodiversity.	1. Attend state, regional, and national meetings of natural resources organizations; and participate in committee sessions on TES and biodiversity.	TBD	See Action 5d-3	USACE Labs
	2. Actively participate in regional workshops on TES of special concern (e.g., red-cockaded woodpecker).	TBD	See Action 5d-3	USACE Labs

Objectives	Actions	Timeline	Resources	POC
	3. Initiate regional TES research technical workshops.	2QFY95	See Action 5d-2	USACE Labs
	4. Establish MOU/MOA's with other agencies to conduct joint, regionally-based TES R&D.	TBD	See Action 5d-3	CERD, USACE Labs
4d. Identify opportunities to support international conservation R&D initiatives directed at TES and biodiversity.	1. Identify professional organizations that sponsor international programs, and opportunities to support their activities.	4QFY94	See Action 5d-3	USACE Labs
	2. Summarize knowledge regarding status of neotropical migratory birds on Army lands. Promote monitoring and management as a basis for full participation in the Partners in Flight Program.	2QFY95	\$50K	USACE Labs
	3. Participate in international TES and biodiversity conferences and workshops.	TBD	TBD	USACE Labs

Table 5. Breakdown of Goal 5, Program Management: Establish the process and management structure to integrate and execute the TES program.

Objectives	Actions	Timeline	Resources	POC
5a. Refine the R&D process to streamline and ensure review and feedback of process and approach between the user and researcher.	1. Establish coordination agreement with DAIM-ED for identification and validation of TES R&D user requirements	2QFY94	EC	CERD
	2. Support annual TES R&D and User Working Group meetings for program development and review.	2QFY94	\$15K	CERD
	3. Co-host annual Conservation Pillar R&D review.	3QFY94	EC	CERD, DAIM-ED
	4. Provide annual program development and execution guidance to USACE Labs.	3QFY94	EC	CERD
5b. Ensure adequate coordination of R&D program elements to correctly target research activities and balance the various funding sources.	1. Support an Army TES program coordinator.	1QFY94	\$25K	CERD
	2. Coordinate support for TES R&D across Army, DOD and other funding sources (e.g., Tri-Service RELIANCE and EQ STRAT)	Ongoing	EC	CERD
	3. Support implementation of the USACE Interlaboratory R&D Partnership Plan.	2QFY94	\$15K	CERD
	4. Provide annual program funding guidance to USACE Labs.	3QFY94	EC	CERD

Objectives	Actions	Timeline	Resources	POC
5c. Establish a process/program structure to ensure that the overall functionality of R&D products and systems meet user requirements.	1. Support development and implementation of the TES Technology Transfer Plan.	3QFY94	See Action 5c-3	CERD
	2. See Actions 5a-2 and 5a-3.			
	3. Support a TES technology transfer task area manager	2QFY94	\$25K	CERD
5d. Ensure that the TES R&D program elements and products consist of and reflect the knowledge that is state-of-the-art in the field.	1. Support development and implementation of the Interagency Coordination Plan.	2QFY94	See Action 5d-3	CERD
	2. Support interagency coordination workshops.	2QFY94	\$30K	CERD/ DAIM-ED
	3. Support a TES interagency coordination task area.	2QFY94	\$25K	CERD

6 Supporting and Carrying out the Strategy

The TES R&D Strategy establishes the foundation and framework for identifying TES-related R&D problems and developing the tools and technologies needed to integrate TES conservation with the mission. The goals, objectives, and actions identified provide the roadmap for carrying out this strategy and for achieving the TES R&D vision.

Progress toward meeting the goals and objectives of the strategy will be monitored to ensure that the strategy is carried out. Specific POCs are identified with each action item to facilitate this outcome. Action-specific resource requirements have also been identified where possible. Note that, while personnel and funding resources are required, many actions represent a new way of doing business rather than an additional drain on resources.

The Army Budget Cycle

The strategy links TES R&D and technology transfer requirements to the Army's key planning, budgeting, and decisionmaking process, similar to the way that the Army's environmental strategy links the environmental program with these processes. As with the environmental strategy, it provides input to, and reflects the goals of The Army Plan (TAP), budget guidance, and the Program Objective Memorandum (POM) (Figure 2). Ultimately, this is the process that establishes priorities.

TAP defines the Army mission and doctrine, and provides the general framework for Army activities. It provides the structure for the Army's total environmental strategy that guides development of the Army environmental program, including TES stewardship activities. Relevant elements of the TES program will influence TAP. This will lead to long-range planning guidance for TES and related environmental programs.

Program budget guidance and funding priorities are attained via the POM. The POM translates Army planning decisions and Secretary of Defense programming guidance into resource allocation for a 6-year period. The TES R&D Strategy can influence this allocation and help define relevant midterm funding priorities. In the near-term, the

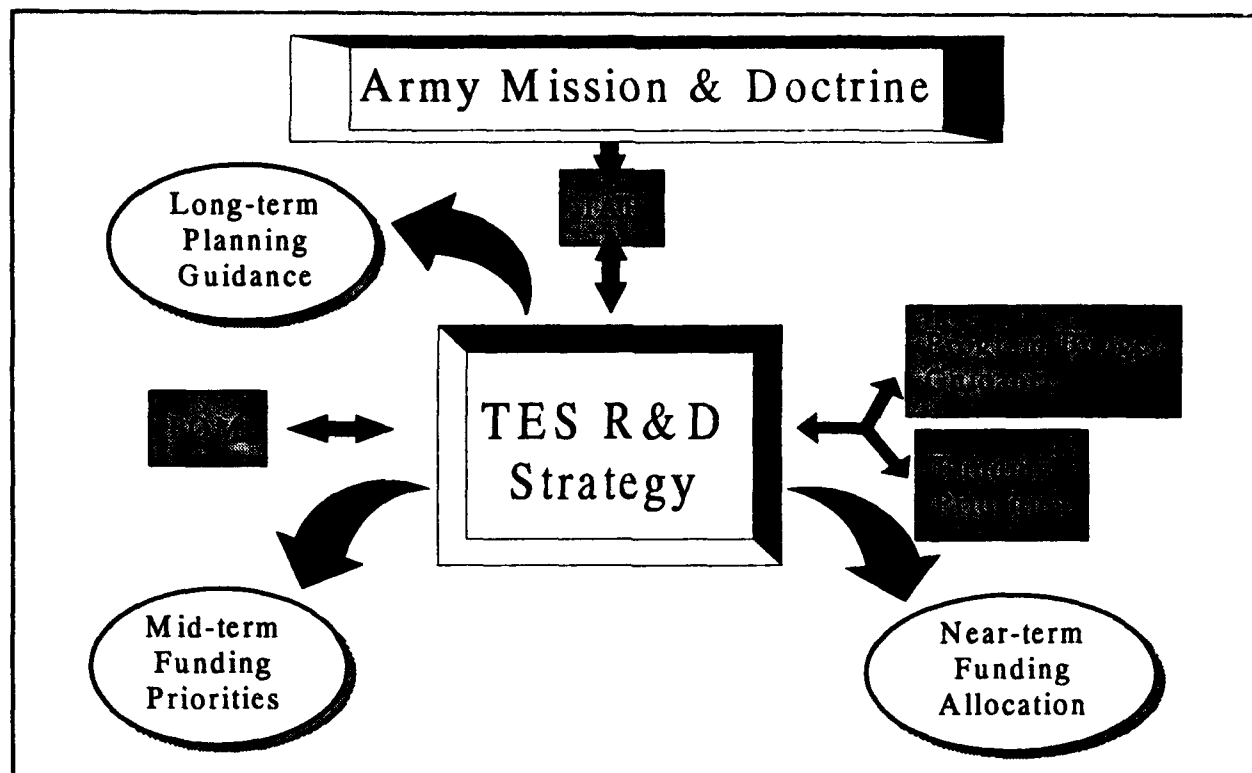


Figure 2. The Army's planning, programming, and budgeting process.

TES R&D Strategy serves to translate program budget guidance and funding priorities into funding for specific R&D activities in 2-year budget cycles.

Monitoring and Updating the Strategy

CERD and DAIM-ED will jointly monitor execution of this strategy and action plan. The USACE Laboratory TES R&D coordinator will brief each office annually on progress made in carrying out the strategy.

The vision, goals, and objectives of the strategy are expected to endure. However, changing and newly emerging environmental legislation and Army guidance require that this be a living document. The strategy will be revisited annually to incorporate necessary updates and modifications. Recommended changes will be subject to CERD and DAIM-ED approval.

Appendix A: Strategy Elements

User Requirements Identification

Identification, validation, and prioritization of user requirements lay the essential foundation on which to build an effective and relevant TES R&D program. The user community will organize itself to effectively articulate these requirements.

The first step in this process, completed during September 1993, was to develop and prioritize a comprehensive set of Conservation Pillar R&D requirements, including TES R&D requirements. Results of this workshop were used to further refine TES-specific requirements. The latter was accomplished in meetings involving TES R&D and user working groups during 2QFY94. Results served as the basis for subsequent design of the TES R&D program. Further review, refinement, and validation of requirements will result from annual Conservation Pillar R&D and user requirement reviews, and regular interactions among the R&D and user working groups (Figure A1).

R&D Design and Execution

The Army must take the necessary positive steps to acquire the information necessary to manage TES wisely. This must be done: (1) together with a fully integrated land management program (i.e., ITAM), and (2) in support of the mission. The Army R&D community can help by identifying, developing, and transferring the appropriate technologies to the field that enable the Army to meet this obligation efficiently and cost-effectively. This assistance must be based on well articulated and prioritized user requirements. Emphasis is also placed on coordination and cooperation with other agencies and organizations involved in TES-related research (see Interagency Coordination below).

CERD and the DAIM-ED will monitor execution of the TES R&D program via an annual R&D review. Modifications to ongoing and proposed R&D activities will follow the annual review. Budgets and the research roadmaps developed serve as CERD's input to the POM (see Figure A2).

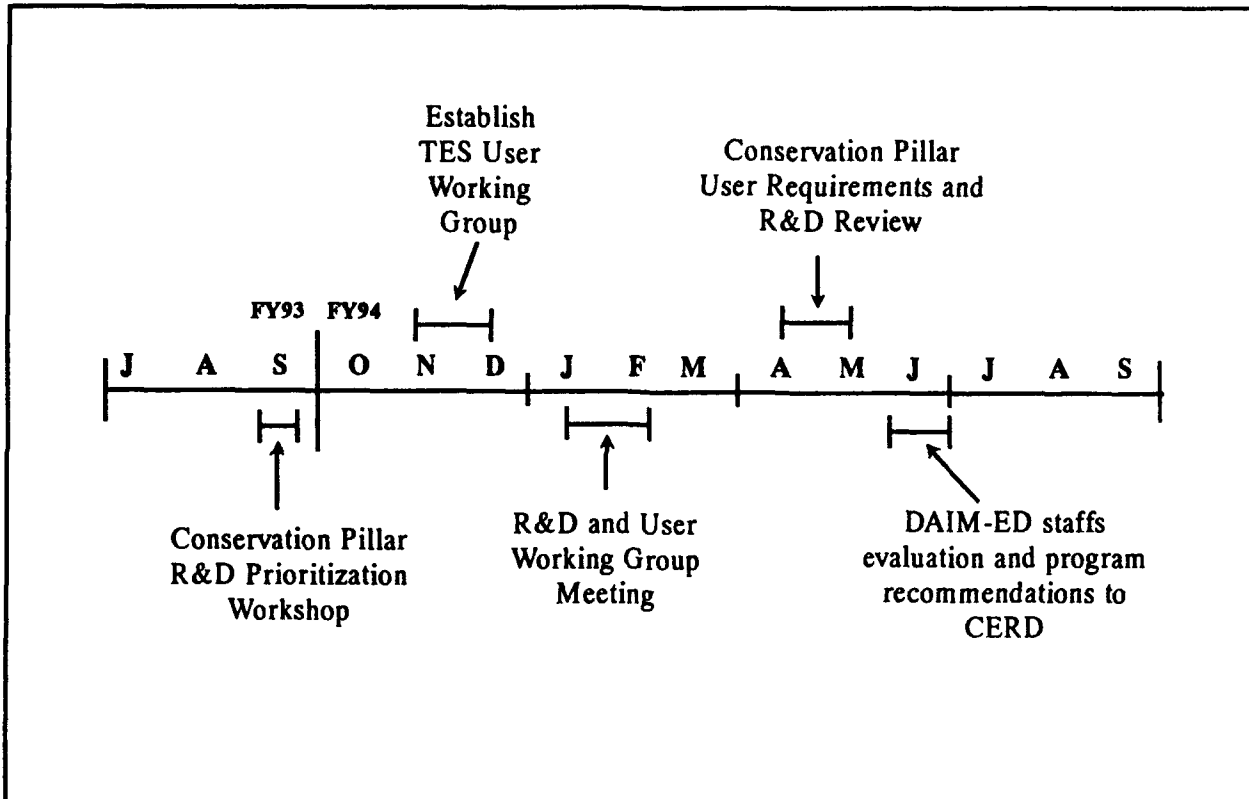


Figure A1. User requirements schedule.

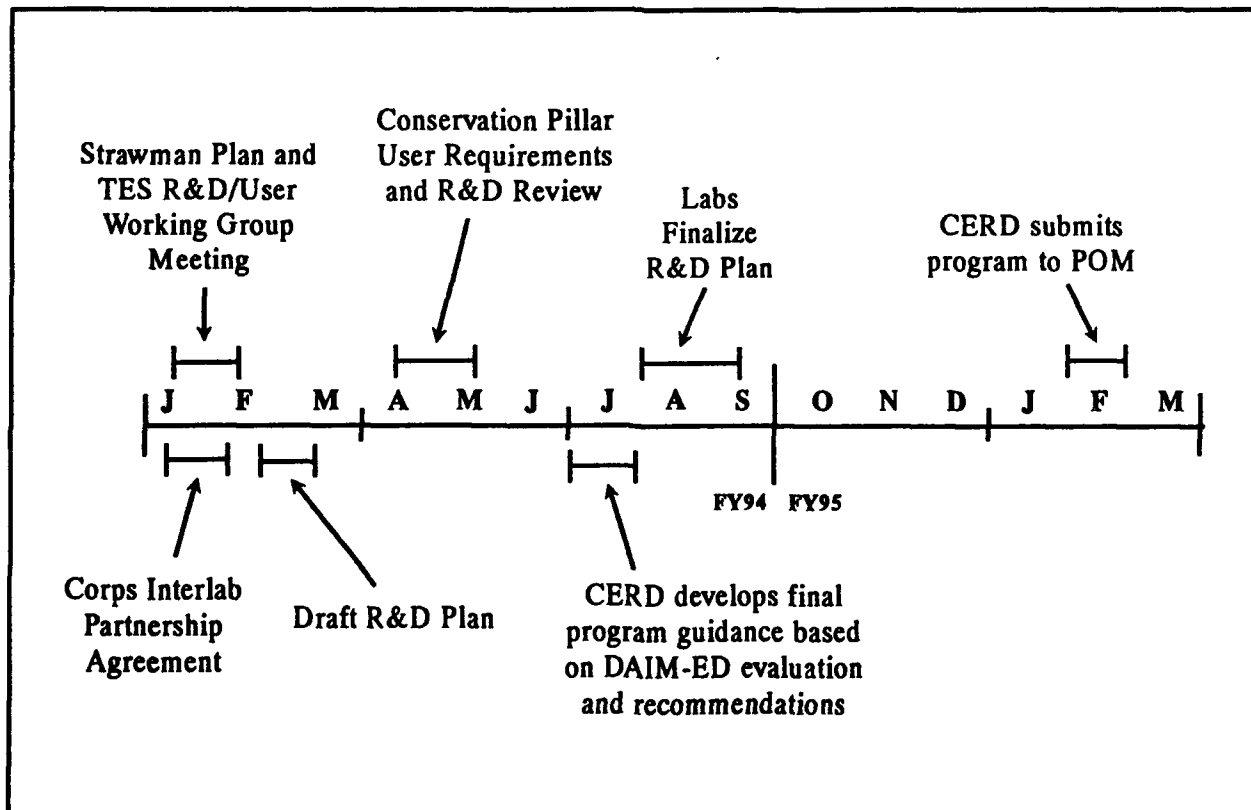


Figure A2. R&D planning and execution schedule.

Coordination among R&D elements and activities within DA and DOD is essential to maximize potential success and benefits of the TES R&D program. Within USACE, program development and execution coordination are being effected via development of an Inter-laboratory TES Reliance Partnership Plan. This plan includes a recommendation to form a USACE TES R&D Coordination Committee consisting of representatives from each laboratory. Beyond this, continuation of the Army TES R&D Working Group will help to maintain broader Army-level coordination, and may serve as the basis for further DOD-level interactions. DOD coordination will continue via the Tri-Service RELIANCE initiative and Tri-Service Environmental Quality R&D Strategic Plan (EQ STRAT). These groups and activities will form the basis for development of a DOD-level TES R&D communications network.

Coordination of diverse funding sources is crucial to successful execution of planned research activities. Current funding sources include:

- Environmental Quality Long-Range Science and Technology Program
- Legacy Resource Management Program
- Strategic Environmental Research and Development Program
- Civil Works R&D Programs
- Military and Civil Works Reimbursable Programs.

Resources available through each will be coordinated at the CERD and Conservation Pillar program management level. Close coordination among DAIM-ED, CERD, and the labs will be essential in this regard.

Technology Transfer

Technology transfer is a major component of the TES R&D Program. The program is committed to developing useful technology from research projects and will use a variety of media to transmit information to potential users. These methods traditionally include technical reports, journal articles, fact sheets, and training products, all of which are useful and appropriate products within DOD channels. However, TES R&D-generated technology will be of interest to a much broader audience. Thus, innovative methods of technology transfer will be explored.

The strong commitment to interagency coordination within the strategy requires that the results of DA TES research be shared with as varied an audience as possible. Included in this effort will be the monitoring of technologies developed by other TES programs and activities, and widespread distribution of Army technology transfer products. An effort will be made to identify technology with high potential for transfer

to state and local governments, academic institutions, conservation organizations, and private enterprise.

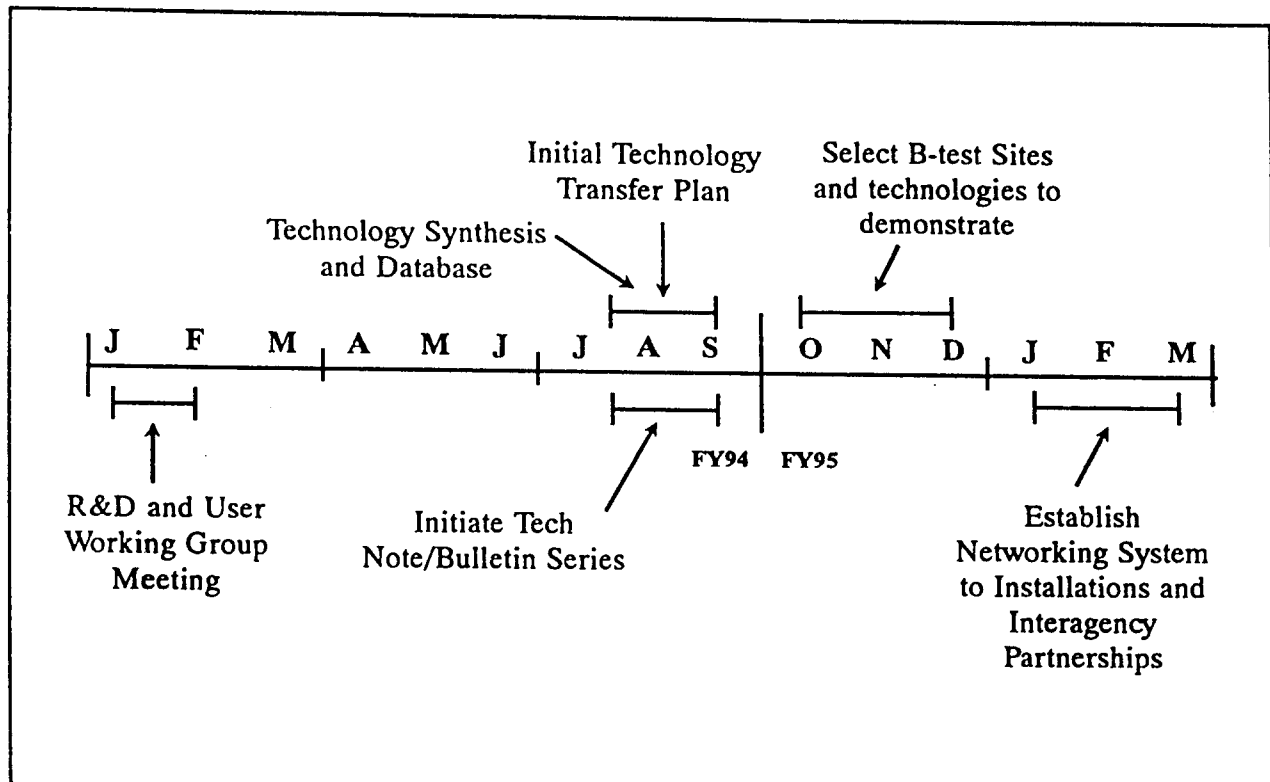
The primary objective of technology transfer is to provide a mechanism through which the results of basic and applied research can be understood and used in a meaningful and productive way. Technology transfer generally includes the following elements:

- Gathering, recording, storing, and transmitting technical information
- Sharing information and exchanging ideas with internal and external audiences as research results are developed
- Converting existing technology and research findings into products, tools, and services
- Providing technical information in a concise and user-friendly form that can be understood and accepted by administrators, managers, and other decisionmakers
- Using the most appropriate and effective media to disseminate products and services to potential users
- Increasing public awareness of the significance and application of technological developments and their relevance to human needs and the quality of life
- Testing and demonstrating research results under actual field conditions
- Maintaining databases generated during technology development to ensure that information is not lost for future application.

A Technology Transfer Plan will be developed early to ensure an R&D focus on timely transfer of useful products and capabilities to the field (Figure A3). Development of this plan is a responsibility of both R&D and the technology proponent (DAIM-ED). The plan will define how R&D interfaces with the user community in the transfer of technical capabilities. It will be subject to a rigorous review and approval process, and will draw on direct participation by the user community, DOD researchers, and inter-agency partners. This will be accomplished through workshops and other modes of communication, and ensure that the basic steps of technology transfer are followed, i.e.,

- Schedule and monitor research products
- Identify users, design products, and prepare draft products
- Obtain proper review and obtain approval to publish products
- Produce and distribute products
- Refine or revise technology transfer processes.

Technology transfer requires application of a variety of media with a clear focus on the intended audience (i.e., user). Potential media formats and products will be designed to reach each of the three user communities identified in Table A1.



Information distribution will occur as a consequence of performing the various functions of technology transfer. The process will require vigilance, close coordination, and cooperation among administrators, managers, researchers, technical support, and media specialists. A major effort at the program level will help to ensure that the primary focus of technology transfer remains on furnishing the field with timely information about new technology. An important step will be to promote and coordinate a thorough review of all draft products before release. An Army TES Technology Transfer Task Area Manager will be designated to manage the TES technology transfer process.

Table A1. Example media products for three user communities.

Audience	Example Products
Technical	Technical reports, conferences, journal articles
Applied user	Technical notes, demonstration projects, workshops, video reports, integration with ITAM
General	Information bulletins and brochures, magazine and newspaper articles

Interagency Coordination

Several federal agencies are making a considerable effort to address a broad range of TES, biodiversity, and ecosystem-related research. Some of these efforts undoubtedly are mission-specific, but much has the potential to be broadly applicable to TES research and management across agency lines. Therefore, it is essential to establish a mechanism to share information and to coordinate and cooperate with other government and nongovernment agencies conducting TES-related research. The major focus is to identify instances of duplication of effort and opportunities to leverage limited resources for accomplishment of common goals. This will be accomplished via the activities described below.

Proposed interagency coordination activities include cooperative efforts with a variety of federal agencies, DOD branches, states and nongovernmental organizations. The intent is to develop and continuously assess the progress and results of research and demonstration projects. This may include collaborative work at the field level and development of interagency documents on TES. The scope of this effort extends from the national to the program level. At the national level, it involves Headquarters USACE, DAIM-ED Staff, and the Corps' TES Program Management. At the program level, it requires regional and site-specific coordination. The major actions associated with this effort include administrative-level and regional/technical interagency workshops (Figure A4).

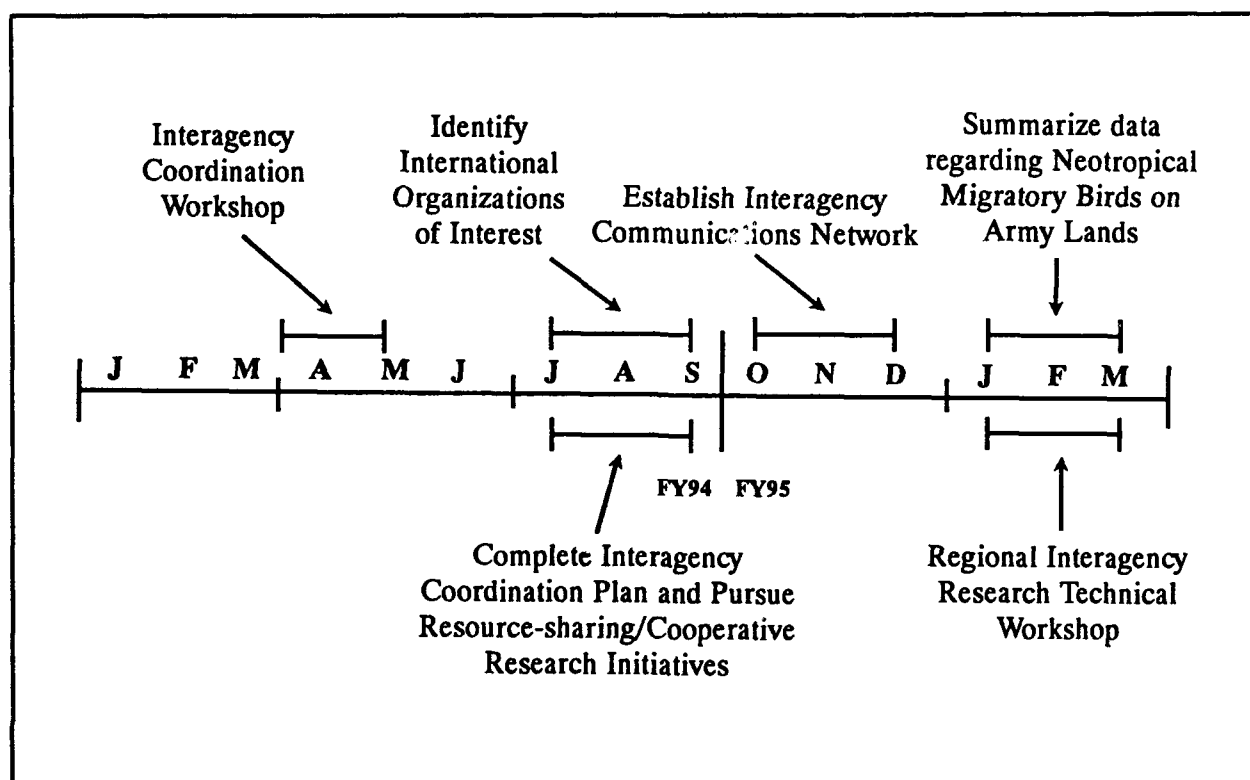


Figure A4. Interagency coordination and cooperation schedule.

Interagency Workshops

The U.S. Army, the U.S. Fish and Wildlife Service, and the National Biological Survey co-hosted an interagency symposium during April 1994 to exchange information regarding the TES research and management activities of each agency. The meeting was targeted at headquarters level staff. Participants identified TES-related information needs, major gaps in existing information, and mechanisms to improve information sharing among Federal agencies. Goals will be established for future interagency cooperation, and specific recommendations developed for follow-on actions.

Regional Interagency TES Research and Technical Workshops

Regional and other technical meetings will be conducted to bring together organizations and personnel involved in similar or related TES research within specific regions of the United States. These will focus on specific technical problems and the approaches employed to address those problems within the region. These could include existing management approaches as well as ongoing research designed to develop new capabilities or improve upon existing capabilities

Establishing a TES Interagency Coordination Task Area Manager will help ensure efficient and effective coordination with a broad range of agencies and organizations involved in TES-related R&D. The initial responsibility of this position will be to develop an Interagency Coordination Plan. This plan will describe actions to be taken to avoid duplication of R&D and identify opportunities for partnerships. Furthermore, the plan will address:

- Coordination with private conservation groups
- Interaction with traditional Army and Corps constituencies
- Development of coordinated research documentation among various federal agencies
- Participation in national, regional, and ad hoc committees and working groups
- Technical-level participation in professional societies and activities
- Interaction with regional, state, and local organizations regarding TES research and demonstration projects
- Search for partnering opportunities to increase the scope and support of TES R&D and technology transfer efforts
- Search for opportunities to exchange information and interaction in areas of mutual interest at the international level.

One area of particular interest on the international front is the Partners in Flight Program. This initiative has developed under leadership of the National Fish and

Wildlife Association to foster conservation of neotropical migratory birds, i.e., those avian species that migrate between breeding areas in North America and wintering areas in South and Central America. The Army and DOD participate in this activity by virtue of a recently signed federal agency MOA. The Army R&D community can begin to formally participate in this effort immediately.

Program Management

Program management is a strategic process that binds the individual processes above together in a program matrix. The processes themselves are part of program management, but are nonfunctional outside the context of the whole. It is the responsibility of program management to assure the pieces work together to support the TES R&D vision. First, it is important to recognize the process owners and then to identify how each interfaces to meet the goals of program management (Table A2).

Figure A5 shows the interface between the processes. The interface between the User Requirements process and R&D Design and Execution occurs via direct coordination between DAIM-ED and CERD, regular interaction between the TES R&D and user working groups, and the annual Conservation Pillar R&D and user requirements review.

The interface between R&D and Technology Transfer is the responsibility of the laboratories, and is effective only to the extent that it satisfies user needs. In effect, technology transfer is the interface between R&D and the user on the product-side of the process. This interface centers on development of a Technology Transfer Plan. Periodic user workshops and a host of technology transfer products and media defined within the plan will support the process. CERD's role is to monitor the process and ensure responsiveness to the users.

Table A2. Program management process owners.

Process	Process Owner
User Requirements	DAIM-ED
R&D Design and Execution	CERD/USACE Labs
Technology Transfer	DAIM-ED/USACE Labs
Interagency Coordination	DAIM-ED/CERD/USACE Labs
Program Management	CERD

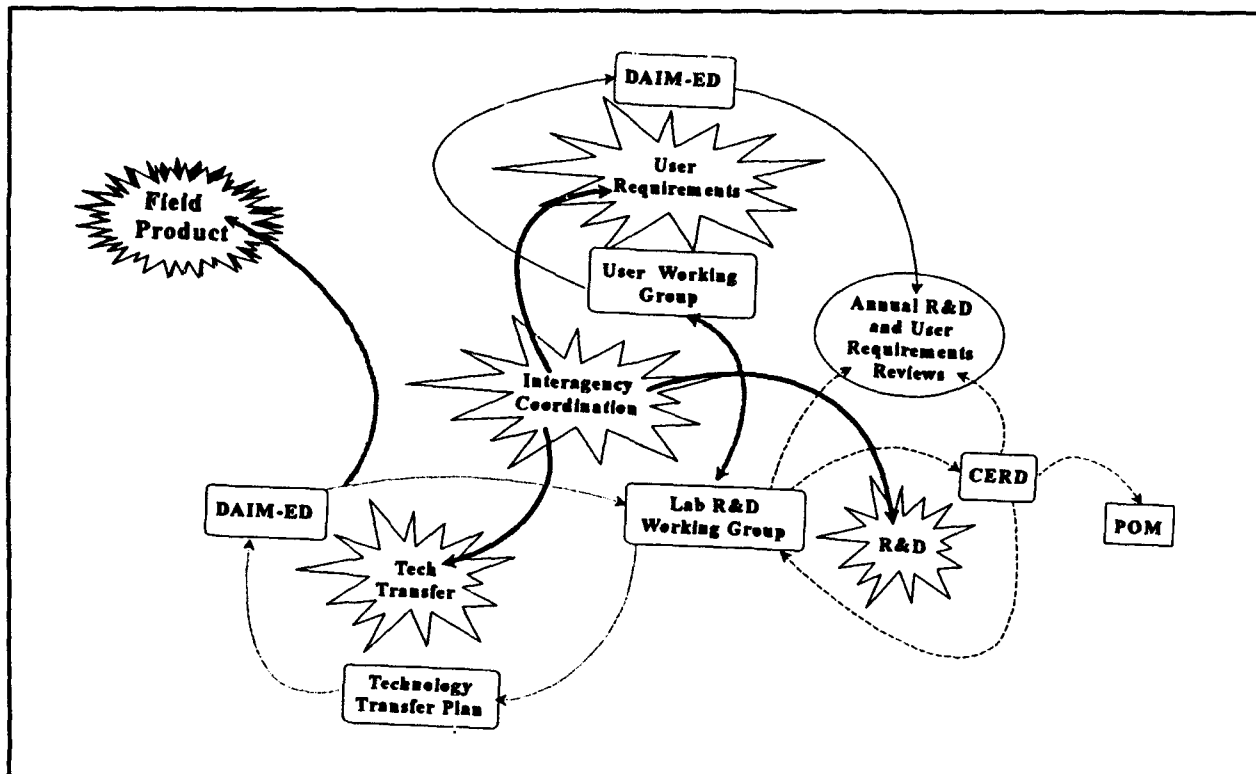


Figure A5. Overall program management cycle.

Interagency coordination, as it relates to R&D and technology transfer, is a shared responsibility of CERD, DAIM-ED, and USACE Labs. The user community must develop an awareness of products and capabilities available via other agencies and organizations in an effort to better define and prioritize R&D requirements. The research community must maintain awareness of ongoing R&D within other organizations, and partner with those agencies when appropriate. R&D must also help the Army in adapting and transferring technologies developed by others when and where appropriate.

Overall, it is CERD's responsibility to monitor each of the process elements to ensure timely development of cost-effective and desired products. CERD will program the TES R&D dollars and allocate personnel necessary to put the agreed upon R&D program into effect. That office will also work with lab program managers to leverage the full range of funding sources available, and establish an interface between TES R&D within the Conservation Pillar and the Tri-service RELIANCE and EQ STRAT Plan.

Appendix B: Glossary of Acronyms and Definitions

Acronyms

AEHA	Army Environmental Hygiene Agency
AEPI	Army Environmental Policy Institute
CEMML	Center for Ecological Management of Military Lands, Colorado State University
CERD	Corps of Engineers Directorate of Research and Development
DA	Department of the Army
DAIM-ED	Office of the Director of Environmental Programs
DAMO-TRS	Directorate of Training, Office of the Deputy Chief of Staff for Operations and Plans
DOD	Department of Defense
EC	Embedded Cost
ERDEC	Edgewood Research, Development and Engineering Center
ESA	Endangered Species Act
EQSTRAT	Environmental Quality Strategic Plan
HQ	Headquarters
ITAM	Integrated Training Area Management
MACOM	Major Command
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NSBIT	Noise and Sonic Boom Impact Technology
POC	Point of contact
POM	Program Objective Memorandum
R&D	Research and Development

RCW	Red-cockaded Woodpecker
TAP	The Army Plan
TBD	To be determined
TES	Threatened and Endangered Species
USACE	U.S. Army Corps of Engineers

Definitions

Biodiversity/Biological Diversity. The variety of life, and its processes. It includes the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.

Candidate Species. A species being considered for listing as a federally threatened or endangered species.

Conserve/Conservation. To use and the use of all methods and procedures that are necessary to bring any threatened or endangered species to the point at which the measures provided pursuant to the ESA are no longer necessary.

Conservation Pillar. Major element of the Army's environmental strategy. The goal is to conserve, protect, and enhance environmental, natural, and cultural resources, using all practical means consistent with Army missions, so that present and future generations may use and enjoy them.

Ecosystem. The organisms of a particular habitat or an ecological community together with the physical environment in which they live. The dynamic complex of plant and animal communities and their associated nonliving environment.

Endangered Species. Any species listed pursuant to the ESA that is in danger of extinction throughout all or a significant portion of its range.

Listed Species. Any species of fish, wildlife, or plant that has been determined to be threatened or endangered under provisions of the ESA.

Recovery Plan. A plan developed by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, as required by the ESA, for the conservation and survival of a listed species.

RELIANCE. A programmatic initiative of the DOD to improve the efficiency and productivity of the DOD's research, development, and acquisition process. This is to be accomplished via "reliance" on each laboratory's programs and resources.

Species. A population or series of populations of organisms that are capable of interbreeding freely with each other but not with members of other species. Under the ESA, includes any subspecies of fish or wildlife or plant, and any distinct population segment of any species or vertebrate fish or wildlife that interbreeds when mature.

Threatened Species. Any species listed pursuant to the ESA that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Wildlife. Living, nondomesticated animals.

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